

SEQUENCE LISTING

<110> Allen, Stephen M.
Caimi, Perry G.
Stoop, Johan M.

<120> Fructan Biosynthetic Enzymes

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<150> 60/269,543

<151> 2001-02-16

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<213> Dimorphotheca sinuata

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Leu Ile Val Ser Val Leu Phe Leu Asn Gln Gln Asn Ser Ser His Ser
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Thr Thr Asn Ser Lys Ser Ile Ser Gln Ser Asp Arg Leu Ile Trp Glu
65 70 75 80

Arg Thr Ser Phe His Phe Gln Pro Ala Lys Asn Phe Ile Tyr Asp Pro
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Asn Gly Pro Leu Phe His Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr
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Asn Pro Tyr Gly Pro Val Trp Gly Asn Met Ser Trp Gly His Ser Val
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Ser Lys Asp Met Ile Asn Trp Phe Glu Leu Pro Val Ala Leu Val Pro
130 135 140

Thr Glu Trp Tyr Asp Ile Glu Gly Val Leu Ser Gly Ser Thr Thr Val
145 150 155 160

Leu Pro Asn Gly Gln Ile Phe Ala Leu Tyr Thr Gly Asn Ala Asn Asp
165 170 175

Phe Ser Gln Leu Gln Cys Lys Ala Val Pro Val Asn Ile Ser Asp Pro
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Leu Leu Ile Glu Trp Val Lys Tyr Asp Gly Asn Pro Ile Leu Tyr Thr
195 200 205

Pro Pro Gly Ile Gly Leu Lys Asp Tyr Arg Asp Pro Ser Thr Val Trp
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Thr Gly Pro Asp Gly Lys His Arg Met Ile Met Gly Ser Lys Arg Asn
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Lys Thr Gly Leu Val Leu Val Tyr His Thr Thr Asp Phe Thr Asn Tyr
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Val Met Ser Asp Glu Pro Leu His Ser Val Pro Asn Thr Asp Met Trp
 260 265 270
 Glu Cys Val Asp Phe Tyr Pro Val Ser Leu Thr Asn Asp Ser Ala Leu
 275 280 285
 Asp Met Ala Ala Tyr Gly Ser Gly Ile Lys His Val Ile Lys Glu Ser
 290 295 300
 Trp Glu Gly His Gly Met Asp Trp Tyr Ser Ile Gly Thr Tyr Asp Ala
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 Ser Thr Asp Lys Trp Thr Pro Asp Asn Pro Lys Leu Asp Val Gly Ile
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 Gly Leu Arg Cys Asp Tyr Gly Lys Phe Phe Ala Ser Lys Ser Leu Phe
 340 345 350
 Asp Pro Leu Lys Lys Arg Arg Val Thr Trp Gly Tyr Val Gly Glu Ser
 355 360 365
 Asp Lys Pro Asp Gln Asp Leu Ser Arg Gly Trp Ala Thr Ile Tyr Asn
 370 375 380
 Val Ala Arg Thr Val Val Leu Asp Arg Lys Thr Gly Thr His Leu Leu
 385 390 395 400
 His Trp Pro Val Glu Glu Ile Glu Ser Leu Arg Ser Asn Gly Gln Glu
 405 410 415
 Phe Asn Glu Ile Glu Leu Lys Pro Gly Ser Ile Ile Pro Leu Asp Ile
 420 425 430
 Gly Ser Ala Thr Gln Leu Asp Ile Val Ala Thr Phe Glu Val Asp Gln
 435 440 445
 Asp Ala Leu Lys Ala Ile Ser Glu Thr Asn Glu Glu Tyr Ile Cys Thr
 450 455 460
 Lys Ser Trp Gly Ala Ala Gly Arg Gly Ser Leu Gly Pro Phe Gly Val
 465 470 475 480
 Ala Val Leu Ala Asp Gly Thr Leu Ser Glu Leu Thr Pro Val Tyr Phe
 485 490 495
 Tyr Ile Ala Lys Asn Thr Asp Gly Ser Val Ala Thr His Phe Cys Thr
 500 505 510
 Asp Lys Leu Arg Ser Ser Leu Asp Tyr Asp Arg Glu Arg Val Val Tyr
 515 520 525
 Gly Ser Thr Val Pro Val Leu Asp Gly Glu Glu Leu Thr Met Arg Leu
 530 535 540
 Leu Val Asp His Ser Val Val Glu Gly Phe Ala Gln Gly Gly Arg Thr
 545 550 555 560
 Val Ile Thr Ser Arg Val Tyr Pro Thr Lys Ala Ile Tyr Asp Asn Ala
 565 570 575

下卷第十一章

Lys Val Phe Leu Phe Asn Asn Ala Thr Gly Thr Ser Val Lys Ala Ser
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Leu Lys Ile Trp Gln Met Ala Pro Ala Gln Ile Lys Pro Tyr Pro Leu
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<210> 4
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Thr Asn Ile Ser Val Lys Tyr Ser Gln Ser Asp Arg Leu Thr Trp Glu
 65 70 75 80

Arg Thr Ala Phe His Phe Gln Pro Ala Lys Asn Phe Ile Tyr Asp Pro
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Asn Gly Gln Met Tyr Tyr Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr
 100 105 110

Asn Pro Tyr Ala Pro Val Trp Gly Asn Met Ser Trp Gly His Ser Val
 115 120 125

Ser Lys Asp Met Ile Asn Trp Tyr Glu Leu Pro Val Ala Ile Val Pro
 130 135 140

Thr Glu Trp Tyr Asp Ile Glu Gly Val Leu Ser Gly Ser Ile Thr Val
 145 150 155 160

Leu Pro Asn Gly Gln Ile Phe Ala Leu Tyr Thr Gly Asn Ala Asn Asp
 165 170 175

Phe Ser Gln Leu Gln Cys Lys Ala Val Pro Val Asn Ser Ser Asp Pro
 180 185 190

Leu Leu Val Glu Trp Val Lys Tyr Glu Asp Asn Pro Ile Leu Tyr Thr
 195 200 205

Pro Pro Gly Ile Gly Leu Lys Asp Tyr Arg Asp Pro Ser Thr Val Trp
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Thr Gly Pro Asp Gly Lys His Arg Met Ile Met Gly Thr Lys Arg Gly
 225 230 235 240

Asn Thr Gly Met Ile Leu Val Tyr His Thr Thr Asp Tyr Thr Asn Tyr
 245 250 255

Glu Met Leu Asn Glu Pro Met His Ser Val Pro Asn Thr Asp Met Trp
 260 265 270

Glu Cys Val Asp Phe Tyr Pro Val Ser Leu Thr Asn Asp Ser Ala Leu
 275 280 285

Asp Ile Ala Ala Tyr Gly Ser Gly Ile Lys His Val Ile Lys Glu Ser
 290 295 300

Trp Glu Gly Tyr Gly Met Asp Phe Tyr Ser Ile Gly Thr Tyr Asp Ala
 305 310 315 320

Phe Asn Asp Lys Trp Thr Pro Asp Asn Pro Glu Leu Asp Val Gly Ile
 325 330 335

Gly Leu Arg Cys Asp Tyr Gly Arg Phe Phe Ala Ser Lys Ser Ile Phe
340 345 350

Asp Pro Val Lys Lys Arg Arg Ile Thr Trp Ala Tyr Val Gly Glu Ser
355 360 365

Asp Asn Ala Asp Asp Asp Leu Ser Arg Gly Trp Ala Thr Ile Tyr Asn
370 375 380

Val Gly Arg Thr Ile Val Leu Asp Arg Lys Thr Gly Thr His Leu Leu
385 390 395 400

His Trp Pro Val Glu Glu Ile Glu Ser Leu Arg Tyr Asn Gly Gln Glu
405 410 415

Phe Lys Glu Ile Lys Leu Glu Pro Gly Ser Ile Ala Pro Leu Asp Ile
420 425 430

Gly Thr Ala Thr Gln Leu Asp Ile Val Ala Thr Phe Lys Val Asp Glu
435 440 445

Ala Ala Leu Asn Ala Thr Ser Glu Thr Asp Asp Asn Phe Ala Cys Thr
450 455 460

Thr Ser Ser Gly Ala Val Glu Arg Gly Ser Leu Gly Pro Phe Gly Leu
465 470 475 480

Ala Val Leu Ala Asp Gly Thr Leu Ser Glu Leu Thr Pro Val Tyr Phe
485 490 495

Tyr Ile Ala Lys Lys Ala Asp Gly Gly Val Ser Thr His Phe Cys Thr
500 505 510

Asp Lys Leu Arg Ser Ser Leu Asp Phe Asp Lys Glu Arg Val Val Tyr
515 520 525

Gly Ser Thr Val Pro Val Leu Asp Asp Glu Glu Leu Thr Met Arg Leu
530 535 540

Leu Val Asp His Ser Val Val Glu Ala Phe Ala Gln Gly Gly Arg Ile
545 550 555 560

Ala Ile Thr Ser Arg Val Tyr Pro Thr Lys Ala Ile Tyr Glu Gly Ala
565 570 575

Lys Leu Phe Leu Phe Asn Asn Ala Thr Asp Thr Ser Val Lys Ala Ser
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Leu Lys Ile Trp Gln Met Ala Ser Ala Gln Ile His Gln Tyr Glu Phe
595 600 605

Asn

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<212> DNA
<213> Helianthus sp.

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<212> PRT

<213> Helianthus sp.

<400> 6

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Thr Asp Tyr Thr Asn Tyr Glu Leu Leu Asp Glu Pro Leu His Ser Val
35 40 45

Pro Asn Thr Asp Met Trp Glu Cys Val Asp Phe Tyr Pro Val Ser Leu
50 55 60

Thr Asn Asp Ser Ala Leu Asp Met Ala Ala Tyr Gly Ser Gly Ile Lys
65 70 75 80

His Val Ile Lys Glu Ser Trp Glu Gly His Gly Met Asp Trp Tyr Ser
85 90 95

Ile Gly Thr Tyr Asp Ala Ile Asn Asp Lys Trp Thr Pro Asp Asn Pro
100 105 110

Glu Leu Asp Val Gly Ile Gly Leu Arg Cys Asp Tyr Gly Lys Phe Phe
115 120 125

Ala Ser Lys Ser Leu Tyr Asp Pro Leu Lys Lys Arg Arg Val Thr Trp
130 135 140

Ala Tyr Val Gly Glu Ser Asp Ser Val Asp Gln Asp Leu Ser Arg Gly
145 150 155 160

Trp Ala Thr Val Tyr Asn Val Gly Arg Thr Ile Val Leu Asp Arg Lys
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 Thr Gly Thr His Leu Leu His Trp Pro Val Glu Glu Val Glu Ser Leu
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 Arg Tyr Asn Gly Gln Glu Phe Lys Glu Ile Glu Leu Glu Pro Gly Ser
 195 200 205
 Ile Ile Pro Leu Asp Ile Gly Thr Ala Thr Gln Leu Asp Ile Val Ala
 210 215 220
 Thr Phe Glu Val Asp Gln Ala Ala Leu Asn Ala Thr Ser Glu Thr Asp
 225 230 235 240
 Asp Ile Tyr Gly Cys Thr Thr Ser Leu Gly Ala Ala Gln Arg Gly Ser
 245 250 255
 Leu Gly Pro Phe Gly Leu Ala Val Leu Ala Asp Gly Thr Leu Ser Glu
 260 265 270
 Leu Thr Pro Val Tyr Phe Tyr Ile Ala Lys Lys Ala Asp Gly Gly Leu
 275 280 285
 Ser Thr His Phe Cys Thr Asp Lys Leu Arg Ser Ser Leu Asp Tyr Asp
 290 295 300
 Gly Gln Arg Val Val Tyr Gly Ser Thr Val Pro Val Leu Asp Asp Glu
 305 310 315 320
 Glu Leu Thr Met Arg Leu Leu Val Asp His Ser Ile Val Glu Gly Phe
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 Ala Ile Tyr Glu Gln Ala Lys Leu Phe Leu Phe Asn Asn Ala Thr Gly
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 <213> Triticum aestivum

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 35 40 45

 Tyr Thr Gly Ala Thr Asn Ala Ser Ala Ile Glu Val Gln Cys Ile Ala
 50 55 60

 Thr Pro Ala Asp Pro Asn Asp Pro Phe Leu Arg Arg Trp Thr Lys His
 65 70 75 80

 Pro Ala Asn Pro Val Ile Trp Ser Pro Pro Gly Ile Gly Thr Lys Asp
 85 90 95

 Phe Arg Asp Pro Met Thr Ala Trp Tyr Asp Glu Ser Asp Asp Thr Trp
 100 105 110

 Arg Thr Leu Leu Gly Ser Lys Asp Asp Gln Asp Gly His His Asp Gly
 115 120 125

 Ile Ala Met Met Tyr Lys Thr Lys Asp Phe Leu Asn Tyr Glu Leu Ile
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 Pro Gly Ile Leu His Arg Val Glu Arg Thr Gly Glu Trp Glu Cys Ile
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Asp Phe Tyr Pro Val Gly Arg Arg Ser Ser Asp Asn Ser Ser Glu Met
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 Leu His Val Leu Lys Ala Ser Met Asp Asp Glu Arg His Asp Tyr Tyr
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 Ser Leu Gly Thr Tyr Asp Ser Ala Ala Asn Thr Trp Thr Pro Ile Asp
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 Pro Asp Leu Asp Leu Gly Ile Gly Leu Arg Tyr Asp Trp Gly Lys Phe
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 Tyr Ala Ser Thr Ser Phe Tyr Asp Pro Ala Lys Lys Arg Arg Val Leu
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 Met Gly Tyr Val Gly Glu Val Asp Ser Lys Arg Ala Asp Val Val Lys
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 Gly Trp Ala Ser Ile Gln Ser Val Pro Arg Thr Ile Ala Leu Asp Glu
 260 265 270
 Lys Thr Arg Thr Asn Leu Leu Leu Trp Pro Val Glu Glu Ile Glu Thr
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 Lys Asp Val Thr Lys Arg Val Ile Gly Ser Thr Val Pro Val Leu Asp
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 Gly Glu Ala Phe Ser Met Arg Val Leu Val Asp His Ser Ile Val Gln
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Ala His Asn Gln Leu Ser Asn Met Asp Asp Tyr Ser Tyr Val Gln
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Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr Asn Ala Ser
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Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro Asn Asp Pro
35 40 45

Phe Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val Ile Trp Ser
50 55 60

Pro Pro Gly Ile Gly Thr Lys Asp Phe Arg Asp Pro Met Thr Ala Trp
65 70 75 80

Tyr Asp Glu Ser Asp Asp Thr Trp Arg Thr Leu Leu Gly Ser Lys Asp
85 90 95

Asp His Asp Gly His His Asp Gly Ile Ala Met Met Tyr Lys Thr Lys
 100 105 110

Asp Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His Arg Val Gln
 115 120 125

Arg Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val Gly His Arg
 130 135 140

Ser Asn Asp Asn Ser Ser Glu Met Leu His Val Leu Lys Ala Ser Met
 145 150 155 160

Asp Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr Asp Ser Ala
 165 170 175

Ala Asn Ala Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu Gly Ile Gly
 180 185 190

Leu Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser Phe Tyr Asp
 195 200 205

Pro Ala Lys Lys Arg Arg Val Leu Met Gly Tyr Val Gly Glu Val Asp
 210 215 220

Ser Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile Gln Ser Val
 225 230 235 240

Pro Arg Thr Ile Ala Leu Asp Glu Lys Thr Arg Thr Asn Leu Leu Leu
 245 250 255

Trp Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala Thr Glu Leu
 260 265 270

Ser Asp Val Thr Leu Asn Thr Gly Ser Val Ile His Ile Pro Leu Arg
 275 280 285

Gln Gly Thr Gln Leu Asp Ile Glu Ala Thr Phe His Leu Asp Ala Ser
 290 295 300

Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr Asn Cys Ser Ser
 305 310 315 320

Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro Phe Gly Leu Leu
 325 330 335

Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr Ala Val Tyr Phe
 340 345 350

Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr Ser Phe Cys Gln
 355 360 365

Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr Lys Arg Val Ile
 370 375 380

Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Phe Ser Met Arg Val
 385 390 395 400

Leu Val Asp His Ser Ile Val Gln Gly Phe Ala Met Gly Gly Arg Thr
 405 410 415

Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ala Tyr Gln Glu Ala Lys
420 425 430

Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Met Ala Glu Arg
435 440 445

Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu Ser Asn Met
450 455 460

Asp Asp His Ser Tyr Val Gln
465 470

<210> 11

<211> 476

<212> DNA

<213> Triticum aestivum

<400> 11

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tacttgttca acaatgccac cgggccagc gttacggccgg aaaggctcg tctgcacgag 120
atggacttcg cacacaacca gctctccaat atggacgatt actcgatgt tcaatgaagc 180
tcttgcatct catcagtaat aagctacatt ggatcaaaga cgctcaccaa ggaaggccaa 240
gacatatatt taaacgattc cgcacagcct cgcttgcaga attgaaacat ctatccttgg 300
gtcatgttct gcattgtatgt cacagtgaac tatattactt tgttgggtgt aggatcgata 360
tagttgggt gggtggaaact ttgttgttt acatagtgaa ccgggtgtgt ctgcataata 420
agcttatgtg tttgtttaga aatgaatta ttgttgttaa aaaaaaaaaa aaaaaaaa 476

<210> 12

<211> 58

<212> PRT

<213> Triticum aestivum

<400> 12

Ala Arg Ala Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ala Tyr Gln
1 5 10 15

Glu Ala Lys Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Thr
20 25 30

Ala Glu Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu
35 40 45

Ser Asn Met Asp Asp Tyr Ser Tyr Val Gln
50 55

<210> 13

<211> 2093

<212> DNA

<213> Parthenium argentatum Grey

<400> 13

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ccacacctcc tctcattctc cacgatgatc ctgaaaacct ccaggaaccc accggattta 120
cgggggttcg tcgtccatcc atcgaaaaag cgcttgcgt aacccttgg tccggttatgg 180
taatctgtgg tctgggtgt gtaatcagca accagacaca ggtaccacaa gtagccaaca 240
gccatcaagg tgccgccacc acattcacaa ctcagttgcc aaaaatagat atgaaacggg 300
ttccgggaga gttggattcg ggtgctgatg tccaatggca acgctccgct tatcatttc 360
aacctgacaa aaactacatt agtgatcctg atggcccaat gtatcacatg ggatggtacc 420
atctatttta tcagtacaac ccagaatctg ccatatgggg caacatcaca tgggtcact 480

ccgtatccaa agacatgatc aactggttcc atctccctt cgccatgggtt ccggaccatt 540
 ggtacgacat cgaaggcgtc atgacagggtt ccgcacagt cctcccaaac ggtgagatca 600
 tcatgcttta cacgggcaat gcgtacgatc tctcccaagt acaatgctta gcgtacgcag 660
 tcaactcattc agatccactt cttatagagt gaaaaaaaata cgaaggcaac ccggtttat 720
 tgccgcccggc aggggtgggt tacaaggatt ttcgggaccc atctacattt tggctggcc 780
 ccgatggtga atatagaatg gtaatgggtt ccaagcacaac cgagactatt ggttgctt 840
 tgatttacca taccactaat ttacgcatt ttaattgaa tgaggaggtt cttcatgcgg 900
 tccccacatac tggtatgtgg gaatgcgttgc atctttatcc ggtatccacc acacacacaa 960
 acgggttggaa catggtggat aatggccaa atgtaaaata cgtgtgaaa caaagtgggg 1020
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 acccgatgaa cccggaaaac gatgtggta tcgggttaag atacgattac ggaaagttt 1140
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 ggtcactcat tcccctcgag ataggtacag ccacacagtt ggatatagtt ggcacattcg 1440
 aagttgatca aatgatgttgc gaatcaacgc tagaagccga ttttctattt aactgcacga 1500
 ctatgtttggc ctcagttggaa agggcgtgtt tgggaccgtt tgggtgtgtt gttctagctg 1560
 atgcccacgc caccgaaccaa cttcctgtgtt atttctatatt tgcaaaaatg accgacggga 1620
 cgtcaagaac ctactttgtt gctgatgaaa caagatcatc caaggatgtt gacgtgggg 1680
 aatgggtgttga tggaaagcagt gttcctgtcc tccctaacga aaagtacaat atgaggttac 1740
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 gagtgatcc aacgaaggca atttacaacg ctgcgaaggt gttttgttc aacaacgcga 1860
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 cttcccttgcgt tactgggtgg acttcttgcgtt ggctagattt tggcccttat atgtgtgtt 1980
 tactatcgttgc aggtatatgtt cttggactgtt ggggttattt ttgtatattt atatgtatgt 2040
 tctgttactt ttgaggttctt agttaaaaaaa aaaaaaaaaaaa aaaaaaaaaaaa aaa 2093

<210> 14

<211> 635

<212> PRT

<213> Parthenium argentatum Grey

<400> 14

Met	Met	Ala	Ser	Ser	Thr	Thr	Thr	Ser	Pro	Leu	Ile	Leu	His	Asp	Asp
1									10					15	

Pro	Glu	Asn	Leu	Gln	Glu	Pro	Thr	Gly	Phe	Thr	Gly	Val	Arg	Arg	Pro
									25				30		

Ser	Ile	Ala	Lys	Ala	Leu	Cys	Val	Thr	Leu	Val	Ser	Val	Met	Val	Ile
									40				45		

Cys	Gly	Leu	Val	Ala	Val	Ile	Ser	Asn	Gln	Thr	Gln	Val	Pro	Gln	Val
												60			

Ala	Asn	Ser	His	Gln	Gly	Ala	Ala	Thr	Thr	Phe	Thr	Thr	Gln	Leu	Pro
65										75				80	

Lys	Ile	Asp	Met	Lys	Arg	Val	Pro	Gly	Glu	Leu	Asp	Ser	Gly	Ala	Asp
									85				90		95

Val	Gln	Trp	Gln	Arg	Ser	Ala	Tyr	His	Phe	Gln	Pro	Asp	Lys	Asn	Tyr
									100				105		110

Ile	Ser	Asp	Pro	Asp	Gly	Pro	Met	Tyr	His	Met	Gly	Trp	Tyr	His	Leu
									115			120		125	

Phe	Tyr	Gln	Tyr	Asn	Pro	Glu	Ser	Ala	Ile	Trp	Gly	Asn	Ile	Thr	Trp
									130			135		140	

EQUATION

Gly His Ser Val Ser Lys Asp Met Ile Asn Trp Phe His Leu Pro Phe
145 150 155 160

Ala Met Val Pro Asp His Trp Tyr Asp Ile Glu Gly Val Met Thr Gly
165 170 175

Ser Ala Thr Val Leu Pro Asn Gly Glu Ile Ile Met Leu Tyr Thr Gly
180 185 190

Asn Ala Tyr Asp Leu Ser Gln Val Gln Cys Leu Ala Tyr Ala Val Asn
195 200 205

Ser Ser Asp Pro Leu Leu Ile Glu Trp Lys Lys Tyr Glu Gly Asn Pro
210 215 220

Val Leu Leu Pro Pro Pro Gly Val Gly Tyr Lys Asp Phe Arg Asp Pro
225 230 235 240

Ser Thr Leu Trp Leu Gly Pro Asp Gly Glu Tyr Arg Met Val Met Gly
245 250 255

Ser Lys His Asn Glu Thr Ile Gly Cys Ala Leu Ile Tyr His Thr Thr
260 265 270

Asn Phe Thr His Phe Glu Leu Asn Glu Glu Val Leu His Ala Val Pro
275 280 285

His Thr Gly Met Trp Glu Cys Val Asp Leu Tyr Pro Val Ser Thr Thr
290 295 300

His Thr Asn Gly Leu Asp Met Val Asp Asn Gly Pro Asn Val Lys Tyr
305 310 315 320

Val Leu Lys Gln Ser Gly Asp Glu Asp Arg His Asp Trp Tyr Ala Ile
325 330 335

Gly Ser Tyr Asp Trp Val Asn Asp Lys Trp Tyr Pro Asp Asp Pro Glu
340 345 350

Asn Asp Val Gly Ile Gly Leu Arg Tyr Asp Tyr Gly Lys Phe Tyr Ala
355 360 365

Ser Lys Thr Phe Tyr Asp Gln His Lys Lys Arg Arg Val Leu Trp Gly
370 375 380

Tyr Val Gly Glu Thr Asp Pro Glu Lys Tyr Asp Leu Thr Lys Gly Trp
385 390 395 400

Ala Asn Ile Leu Asn Ile Pro Arg Thr Val Val Leu Asp Thr Lys Thr
405 410 415

Lys Thr Asn Leu Ile Gln Trp Pro Ile Glu Glu Thr Glu Lys Leu Arg
420 425 430

Ser Lys Lys Tyr Asp Lys Phe Val Asp Val Glu Leu Arg Pro Gly Ser
435 440 445

Leu Ile Pro Leu Glu Ile Gly Thr Ala Thr Gln Leu Asp Ile Val Ala
450 455 460

DNA sequence

Thr Phe Glu Val Asp Gln Met Met Leu Glu Ser Thr Leu Glu Ala Asp
465 470 475 480

Val Leu Phe Asn Cys Thr Thr Ser Val Gly Ser Val Gly Arg Gly Val
485 490 495

Leu Gly Pro Phe Gly Val Val Leu Ala Asp Ala Gln Arg Thr Glu
500 505 510

Gln Leu Pro Val Tyr Phe Tyr Ile Ala Lys Asp Thr Asp Gly Thr Ser
515 520 525

Arg Thr Tyr Phe Cys Ala Asp Glu Thr Arg Ser Ser Lys Asp Val Asp
530 535 540

Val Gly Lys Trp Val Tyr Gly Ser Ser Val Pro Val Leu Pro Asn Glu
545 550 555 560

Lys Tyr Asn Met Arg Leu Leu Val Asp His Ser Ile Val Glu Gly Phe
565 570 575

Ala Gln Asn Gly Arg Thr Val Val Thr Ser Arg Val Tyr Pro Thr Lys
580 585 590

Ala Ile Tyr Asn Ala Ala Lys Val Phe Leu Phe Asn Asn Ala Thr Gly
595 600 605

Ile Arg Val Lys Ala Ser Val Lys Ile Trp Lys Met Ala Glu Ala Glu
610 615 620

Leu Asn Pro Phe Pro Val Thr Gly Trp Thr Ser
625 630 635

<210> 15

<211> 2107

<212> DNA

<213> Helianthus sp.

<400> 15

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gatggcttca tccaccacca ccacccctct cattctccat gatgaccctg aaaacccccc 120
agaactcacc ggatctccga caactcgctg tctatccatc gcaaaaagtgc ttccggggat 180
ccttgtttcg gttctagttt catgtgctct tgttgcttta atcaacaacc aaacatatga 240
accaccccgcg gccaccacat tcgcaactca gttgccaaat attgatctga agcgggttcc 300
aggaaaatgg gattcgagtg ctgaggttga atggcaacga tccgcttatac attttcaacc 360
cgacaaaaat ttcattatgt atcctgatgg cccaatgtat cacatggat ggtaccatct 420
attctatccatcatacaccctgt aatctgccccat ctggggcaac atcacatggg gccactcggt 480
atcgaaaagac atgatcaact ggttccatct ccctttcgcc atggttcctg accattggta 540
cgacatcgaa ggtgtcatga cgggttcggc tacagtccctc cctaattggtc aaatcatcat 600
gttttacacg ggcaacgcgt acgatcttc ccaagtacaa tgcttggcat acgctgtcaa 660
ctcgccggat ccccttctta tagagtggaa aaaatatgaa ggttaaccctg tcttgttccc 720
accaccagga gtgggctaca aggactttcg ggacccatcc acattgtggt tggccctgaa 780
tggtaatata agaatggtaa tggggtccaa gcacaaacgag actattggat gtgcttgc 840
ttaccatacc actaatttta cgcatatgttga attgaaagag gaggtgcttc atgcagtccc 900
acataacttgtt atgtggaaat gtgttgcattt ttaaccatgt tccaccgtac acacaaacgg 960
gttggacatcg gtggataacg ggccaaatgt taaatacgtg ttgaaaacaaa gtggggatga 1020
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ggatgaccccg gaaaatgtatgttgg attaagatat gattttggaa aatttttatgc 1140
gtccaaagact ttttatgacc aacataagaa gaggagggtc ctttgggct atgttggaga 1200

aaccgatccc	caaaagtatg	acatttcaaa	gggatgggct	aacatttga	atattccaag	1260
aaccgtcggt	ttggacacaa	aaacccaaaac	caatttgatt	caatggccaa	tcgaggaaac	1320
cggaaaacctt	aggtcaaaaa	cgtacgatga	attnaaagac	gtggagcttc	gaccgggtc	1380
actcgttccc	cttgagatag	gcacagccac	acagttggat	atagttgcga	cattcgaaat	1440
cggacccaaaag	atgttggaat	caacgctaga	ggccgatgtt	ctattcaatt	gcacgactag	1500
tgaaggctcg	gttgcaggg	gtgcgttggg	accgttttgtt	gtggtggttc	tagccgatgc	1560
ccaacgctcc	gaacaacttc	ctgtatactt	ctatatcgca	aaagatatcg	atggAACCTC	1620
acgaacttac	tttgtgccg	atgaaacaag	atcatccaaag	gatgttaagcg	tagggaaatg	1680
ggtgtacgga	agcagtgttc	ctgtcctccc	aggcgaaaag	tacaatatga	ggttatttgtt	1740
ggatcattcg	atagtggagg	gatttgcaca	aaacgggaga	accgtggtga	catcaagagt	1800
gtatccaaaca	aaggcqatct	acaacgctgc	gaaggtgtt	ttgttcaaca	acgcgactgg	1860
gatcagtgtg	aaggcgtcg	tcaagatctg	gaagatggcg	aaagcagaac	tcaatccctt	1920
ccctcttcct	gggtggactt	ttgaactttg	atggtttagat	tttggaccct	atatagttat	1980
tatcatgaag	cataagttt	gactggaggg	ggttattattt	taatttata	tgcatgttct	2040
attacttgt	agtttatagt	atataattaa	attattatta	ttaaaaaaaaaa	aaaaaaaaaa	2100
aaaaaaaaa						2107

<210> 16

<211> 630

<212> PRT

<213> *Helianthus* sp.

<400> 16

Met	Met	Ala	Ser	Ser	Thr	Thr	Thr	Thr	Pro	Leu	Ile	Leu	His	Asp	Asp
1					5				10					15	

Pro Glu Asn Leu Pro Glu Leu Thr Gly Ser Pro Thr Thr Arg Arg Leu
20 25 30

Ser Ile Ala Lys Val Leu Ser Gly Ile Leu Val Ser Val Leu Val Thr
35 40 45

Cys Ala Leu Val Ala Leu Ile Asn Asn Gln Thr Tyr Glu Pro Pro Ala
50 55 60

Ala Thr Thr Phe Ala Thr Gln Leu Pro Asn Ile Asp Leu Lys Arg Val
65 70 75 80

Pro Gly Lys Leu Asp Ser Ser Ala Glu Val Glu Trp Gln Arg Ser Ala
85 90 95

Tyr His Phe Gln Pro Asp Lys Asn Phe Ile Ser Asp Pro Asp Gly Pro
100 105 110

Met Tyr His Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr Asn Pro Glu
 115 120 125

Ser Ala Ile Trp Gly Asn Ile Thr Trp Gly His Ser Val Ser Lys Asp
 130 135 140

Met Ile Asn Trp Phe His Leu Pro Phe Ala Met Val Pro Asp His Trp
145 150 155 160

Tyr Asp Ile Glu Gly Val Met Thr Gly Ser Ala Thr Val Leu Pro Asn
165 170 175

Gly Gln Ile Ile Met Leu Tyr Thr Gly Asn Ala Tyr Asp Leu Ser Gln
180 185 190

Val Gln Cys Leu Ala Tyr Ala Val Asn Ser Ser Asp Pro Leu Leu Ile
195 200 205

Glu Trp Lys Lys Tyr Glu Gly Asn Pro Val Leu Phe Pro Pro Pro Gly
210 215 220

Val Gly Tyr Lys Asp Phe Arg Asp Pro Ser Thr Leu Trp Leu Gly Pro
225 230 235 240

Asp Gly Glu Tyr Arg Met Val Met Gly Ser Lys His Asn Glu Thr Ile
245 250 255

Gly Cys Ala Leu Ile Tyr His Thr Thr Asn Phe Thr His Phe Glu Leu
260 265 270

Lys Glu Glu Val Leu His Ala Val Pro His Thr Gly Met Trp Glu Cys
275 280 285

Val Asp Leu Tyr Pro Val Ser Thr Val His Thr Asn Gly Leu Asp Met
290 295 300

Val Asp Asn Gly Pro Asn Val Lys Tyr Val Leu Lys Gln Ser Gly Asp
305 310 315 320

Glu Asp Arg His Asp Trp Tyr Ala Ile Gly Ser Tyr Asp Val Val Asn
325 330 335

Asp Lys Trp Tyr Pro Asp Asp Pro Glu Asn Asp Val Gly Ile Gly Leu
340 345 350

Arg Tyr Asp Phe Gly Lys Phe Tyr Ala Ser Lys Thr Phe Tyr Asp Gln
355 360 365

His Lys Lys Arg Arg Val Leu Trp Gly Tyr Val Gly Glu Thr Asp Pro
370 375 380

Gln Lys Tyr Asp Ile Ser Lys Gly Trp Ala Asn Ile Leu Asn Ile Pro
385 390 395 400

Arg Thr Val Val Leu Asp Thr Lys Thr Lys Thr Asn Leu Ile Gln Trp
405 410 415

Pro Ile Glu Glu Thr Glu Asn Leu Arg Ser Lys Thr Tyr Asp Glu Phe
420 425 430

Lys Asp Val Glu Leu Arg Pro Gly Ser Leu Val Pro Leu Glu Ile Gly
435 440 445

Thr Ala Thr Gln Leu Asp Ile Val Ala Thr Phe Glu Ile Asp Gln Lys
450 455 460

Met Leu Glu Ser Thr Leu Glu Ala Asp Val Leu Phe Asn Cys Thr Thr
465 470 475 480

Ser Glu Gly Ser Val Ala Arg Gly Ala Leu Gly Pro Phe Gly Val Val
485 490 495

Val Leu Ala Asp Ala Gln Arg Ser Glu Gln Leu Pro Val Tyr Phe Tyr
500 505 510

Ile Ala Lys Asp Ile Asp Gly Thr Ser Arg Thr Tyr Phe Cys Ala Asp
 515 520 525
 Glu Thr Arg Ser Ser Lys Asp Val Ser Val Gly Lys Trp Val Tyr Gly
 530 535 540
 Ser Ser Val Pro Val Leu Pro Gly Glu Lys Tyr Asn Met Arg Leu Leu
 545 550 555 560
 Val Asp His Ser Ile Val Glu Gly Phe Ala Gln Asn Gly Arg Thr Val
 565 570 575
 Val Thr Ser Arg Val Tyr Pro Thr Lys Ala Ile Tyr Asn Ala Ala Lys
 580 585 590
 Val Phe Leu Phe Asn Asn Ala Thr Gly Ile Ser Val Lys Ala Ser Ile
 595 600 605
 Lys Ile Trp Lys Met Ala Lys Ala Glu Leu Asn Pro Phe Pro Leu Pro
 610 615 620
 Gly Trp Thr Phe Glu Leu
 625 630
 <210> 17
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 <213> Helianthus tuberosus
 <400> 17
 Met Gln Thr Pro Glu Pro Phe Thr Asp Leu Glu His Glu Pro His Thr
 1 5 10 15
 Pro Leu Leu Asp His His Asn Pro Pro Pro Gln Thr Thr Thr Lys
 20 . 25 30
 Pro Leu Phe Thr Arg Val Val Ser Gly Val Thr Phe Val Leu Phe Phe
 35 40 45
 Phe Gly Phe Ala Ile Val Phe Ile Val Leu Asn Gln Gln Asn Ser Ser
 50 55 60
 Val Arg Ile Val Thr Asn Ser Glu Lys Ser Phe Ile Arg Tyr Ser Gln
 65 70 75 80
 Thr Asp Arg Leu Ser Trp Glu Arg Thr Ala Phe His Phe Gln Pro Ala
 85 90 95
 Lys Asn Phe Ile Tyr Asp Pro Asp Gly Gln Leu Phe His Met Gly Trp
 100 105 110
 Tyr His Met Phe Tyr Gln Tyr Asn Pro Tyr Ala Pro Val Trp Gly Asn
 115 120 125
 Met Ser Trp Gly His Ser Val Ser Lys Asp Met Ile Asn Trp Tyr Glu
 130 135 140
 Leu Pro Val Ala Met Val Pro Thr Glu Trp Tyr Asp Ile Glu Gly Val
 145 150 155 160

Leu Ser Gly Ser Thr Thr Val Leu Pro Asn Gly Gln Ile Phe Ala Leu
165 170 175

Tyr Thr Gly Asn Ala Asn Asp Phe Ser Gln Leu Gln Cys Lys Ala Val
180 185 190

Pro Val Asn Leu Ser Asp Pro Leu Leu Ile Glu Trp Val Lys Tyr Glu
195 200 205

Asp Asn Pro Ile Leu Tyr Thr Pro Pro Gly Ile Gly Leu Lys Asp Tyr
210 215 220

Arg Asp Pro Ser Thr Val Trp Thr Gly Pro Asp Gly Lys His Arg Met
225 230 235 240

Ile Met Gly Thr Lys Arg Gly Asn Thr Gly Met Val Leu Val Tyr Tyr
245 250 255

Thr Thr Asp Tyr Thr Asn Tyr Glu Leu Leu Asp Glu Pro Leu His Ser
260 265 270

Val Pro Asn Thr Asp Met Trp Glu Cys Val Asp Phe Tyr Pro Val Ser
275 280 285

Leu Thr Asn Asp Ser Ala Leu Asp Met Ala Ala Tyr Gly Ser Gly Ile
290 295 300

Lys His Val Ile Lys Glu Ser Trp Glu Gly His Gly Met Asp Trp Tyr
305 310 315 320

Ser Ile Gly Thr Tyr Asp Ala Ile Asn Asp Lys Trp Thr Pro Asp Asn
325 330 335

Pro Glu Leu Asp Val Gly Ile Gly Leu Arg Cys Asp Tyr Gly Arg Phe
340 345 350

Phe Ala Ser Lys Ser Leu Tyr Asp Pro Leu Lys Lys Arg Arg Ile Thr
355 360 365

Trp Gly Tyr Val Gly Glu Ser Asp Ser Ala Asp Gln Asp Leu Ser Arg
370 375 380

Gly Trp Ala Thr Val Tyr Asn Val Gly Arg Thr Ile Val Leu Asp Arg
385 390 395 400

Lys Thr Gly Thr His Leu Leu His Trp Pro Val Glu Glu Val Glu Ser
405 410 415

Leu Arg Tyr Asn Gly Gln Glu Phe Lys Glu Ile Lys Leu Glu Pro Gly
420 425 430

Ser Ile Ile Pro Leu Asp Ile Gly Thr Ala Thr Gln Leu Asp Ile Val
435 440 445

Ala Thr Phe Glu Val Asp Gln Ala Ala Leu Asn Ala Thr Ser Glu Thr
450 455 460

Asp Asp Ile Tyr Gly Cys Thr Thr Ser Leu Gly Ala Ala Gln Arg Gly
465 470 475 480

Ser Leu Gly Pro Phe Gly Leu Ala Val Leu Ala Asp Gly Thr Leu Ser
485 490 495

Glu Leu Thr Pro Val Tyr Phe Tyr Ile Ala Lys Lys Ala Asp Gly Gly
500 505 510

Val Ser Thr His Phe Cys Thr Asp Lys Leu Arg Ser Ser Leu Asp Tyr
515 520 525

Asp Gly Glu Arg Val Val Tyr Gly Gly Thr Val Pro Val Leu Asp Asp
530 535 540

Glu Glu Leu Thr Met Arg Leu Leu Val Asp His Ser Ile Val Glu Gly
545 550 555 560

Phe Ala Gln Gly Gly Arg Thr Val Ile Thr Ser Arg Ala Tyr Pro Thr
565 570 575

Lys Ala Ile Tyr Glu Gln Ala Lys Leu Phe Leu Phe Asn Asn Ala Thr
580 585 590

Gly Thr Ser Val Lys Ala Ser Leu Lys Ile Trp Gln Met Ala Ser Ala
595 600 605

Pro Ile His Gln Tyr Pro Phe
610 615

<210> 18
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<400> 18
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Pro Glu Asn Leu Pro Glu Leu Thr Gly Ser Pro Thr Thr Arg Arg Leu
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Ser Ile Ala Lys Val Leu Ser Gly Ile Leu Val Ser Val Leu Val Ile
35 40 45

Gly Ala Leu Val Ala Leu Ile Asn Asn Gln Thr Tyr Glu Ser Pro Ser
50 55 60

Ala Thr Thr Phe Val Thr Gln Leu Pro Asn Ile Asp Leu Lys Arg Val
65 70 75 80

Pro Gly Lys Leu Asp Ser Ser Ala Glu Val Glu Trp Gln Arg Ser Thr
85 90 95

Tyr His Phe Gln Pro Asp Lys Asn Phe Ile Ser Asp Pro Asp Gly Pro
100 105 110

Met Tyr His Met Gly Trp Tyr His Leu Phe Tyr Gln Tyr Asn Pro Gln
115 120 125

Ser Ala Ile Trp Gly Asn Ile Thr Trp Gly His Ser Val Ser Lys Asp
130 135 140

Met Ile Asn Trp Phe His Leu Pro Phe Ala Met Val Pro Asp His Trp
145 150 155 160

Tyr Asp Ile Glu Gly Val Met Thr Gly Ser Ala Thr Val Leu Pro Asn
165 170 175

Gly Gln Ile Ile Met Leu Tyr Ser Gly Asn Ala Tyr Asp Leu Ser Gln
180 185 190

Val Gln Cys Leu Ala Tyr Ala Val Asn Ser Ser Asp Pro Leu Leu Ile
195 200 205

Glu Trp Lys Lys Tyr Glu Gly Asn Pro Val Leu Leu Pro Pro Pro Gly
210 215 220

Val Gly Tyr Lys Asp Phe Arg Asp Pro Ser Thr Leu Trp Ser Gly Pro
225 230 235 240

Asp Gly Glu Tyr Arg Met Val Met Gly Ser Lys His Asn Glu Thr Ile
245 250 255

Gly Cys Ala Leu Ile Tyr His Thr Thr Asn Phe Thr His Phe Glu Leu
260 265 270

Lys Glu Glu Val Leu His Ala Val Pro His Thr Gly Met Trp Glu Cys
275 280 285

Val Asp Leu Tyr Pro Val Ser Thr Val His Thr Asn Gly Leu Asp Met
290 295 300

Val Asp Asn Gly Pro Asn Val Lys Tyr Val Leu Lys Gln Ser Gly Asp
305 310 315 320

Glu Asp Arg His Asp Trp Tyr Ala Ile Gly Ser Tyr Asp Ile Val Asn
325 330 335

Asp Lys Trp Tyr Pro Asp Asp Pro Glu Asn Asp Val Gly Ile Gly Leu
340 345 350

Arg Tyr Asp Phe Gly Lys Phe Tyr Ala Ser Lys Thr Phe Tyr Asp Gln
355 360 365

His Lys Lys Arg Arg Val Leu Trp Gly Tyr Val Gly Glu Thr Asp Pro
370 375 380

Gln Lys Tyr Asp Leu Ser Lys Gly Trp Ala Asn Ile Leu Asn Ile Pro
385 390 395 400

Arg Thr Val Val Leu Asp Leu Glu Thr Lys Thr Asn Leu Ile Gln Trp
405 410 415

Pro Ile Glu Glu Thr Glu Asn Leu Arg Ser Lys Lys Tyr Asp Glu Phe
420 425 430

Lys Asp Val Glu Leu Arg Pro Gly Ala Leu Val Pro Leu Glu Ile Gly
435 440 445

Thr Ala Thr Gln Leu Asp Ile Val Ala Thr Phe Glu Ile Asp Gln Lys
450 455 460

Triticum aestivum

Met Leu Glu Ser Thr Leu Glu Ala Asp Val Leu Phe Asn Cys Thr Thr
465 470 475 480

Ser Glu Gly Ser Val Ala Arg Ser Val Leu Gly Pro Phe Gly Val Val
485 490 495

Val Leu Ala Asp Ala Gln Arg Ser Glu Gln Leu Pro Val Tyr Phe Tyr
500 505 510

Ile Ala Lys Asp Ile Asp Gly Thr Ser Arg Thr Tyr Phe Cys Ala Asp
515 520 525

Glu Thr Arg Ser Ser Lys Asp Val Ser Val Gly Lys Trp Val Tyr Gly
530 535 540

Ser Ser Val Pro Val Leu Pro Gly Glu Lys Tyr Asn Met Arg Leu Leu
545 550 555 560

Val Asp His Ser Ile Val Glu Gly Phe Ala Gln Asn Gly Arg Thr Val
565 570 575

Val Thr Ser Arg Val Tyr Pro Thr Lys Ala Ile Tyr Asn Ala Ala Lys
580 585 590

Val Phe Leu Phe Asn Asn Ala Thr Gly Ile Ser Val Lys Ala Ser Ile
595 600 605

Lys Ile Trp Lys Met Gly Glu Ala Glu Leu Asn Pro Phe Pro Leu Pro
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Gly Trp Thr Phe Glu Leu
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<212> DNA
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Triticum aestivum

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<213> Triticum aestivum

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35 40 45

Ala Ala Ala Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp Gln Arg
50 55 60

Ser Gly Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp Pro Asn
65 70 75 80

Gly Leu Met Tyr Tyr Asn Gly Trp Tyr His Met Phe Phe Gln Tyr Asn
85 90 95

Pro Val Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His Ala Val
100 105 110

Ser Arg Asn Leu Val Thr Trp Arg Thr Leu Pro Ile Ala Met Val Ala
115 120 125

Asp Gln Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met Thr Val
130 135 140

Leu Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr Asn Ala
145 150 155 160

Ser Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro Asn Asp
165 170 175

Pro Phe Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val Ile Trp
180 185 190

Ser Pro Pro Gly Ile Gly Thr Lys Asp Phe Arg Asp Pro Met Thr Ala
195 200 205

Trp Tyr Asp Glu Ser Asp Asp Thr Trp Arg Thr Leu Leu Gly Ser Lys
210 215 220

Asp Asp His Asp Gly His His Asp Gly Ile Ala Met Met Tyr Lys Thr
225 230 235 240

Lys Asp Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His Arg Val
245 250 255

Gln Arg Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val Gly His
260 265 270

Arg Ser Asn Asp Asn Ser Ser Glu Met Leu His Val Leu Lys Ala Ser
275 280 285

Met Asp Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr Asp Ser
290 295 300

Ala Ala Asn Ala Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu Gly Ile
305 310 315 320

Gly Leu Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser Phe Tyr
325 330 335

Asp Pro Ala Lys Lys Arg Arg Val Leu Met Gly Tyr Val Gly Glu Val
340 345 350

Asp Ser Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile Gln Ser
355 360 365

Val Pro Arg Thr Ile Ala Leu Asp Glu Lys Thr Arg Thr Asn Leu Leu
370 375 380

Leu Trp Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala Thr Glu
385 390 395 400

Leu Ser Asp Val Thr Leu Asn Thr Gly Ser Val Ile His Ile Pro Leu
405 410 415

Arg Gln Gly Thr Gln Leu Asp Ile Glu Ala Thr Phe His Leu Asp Ala
420 425 430

Ser Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr Asn Cys Ser
435 440 445

Ser Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro Phe Gly Leu
450 455 460

Leu Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr Ala Val Tyr
465 470 475 480

Phe Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr Ser Phe Cys
485 490 495

Gln Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr Lys Arg Val
500 505 510

Ile Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Phe Ser Met Arg
515 520 525

Val Leu Val Asp His Ser Ile Val Gln Gly Phe Ala Met Gly Gly Arg
530 535 540

Thr Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ala Tyr Gln Glu Ala
545 550 555 560

Lys Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Met Ala Glu
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Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu Ser Asn
580 585 590

Met Asp Asp His Ser Tyr Val Gln
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Ala Cys Ala Thr Val Leu Thr Ala Ser Ala Met Ala Val Val Val Val
35 40 45

Gly Ala Thr Leu Leu Ala Gly Leu Arg Met Glu Gln Ala Val Asp Glu
50 55 60

Glu Ala Ala Ala Gly Gly Phe Pro Trp Ser Asn Glu Met Leu Gln Trp
65 70 75 80

Gln Arg Ser Gly Tyr His Phe Gln Thr Ala Lys Asn Tyr Met Ser Asp
85 90 95

Pro Asn Gly Leu Met Tyr Tyr Arg Gly Trp Tyr His Met Phe Tyr Gln
100 105 110

Tyr Asn Pro Val Gly Thr Asp Trp Asp Asp Gly Met Glu Trp Gly His
115 120 125

Ala Val Ser Arg Asn Leu Val Gln Trp Arg Thr Leu Pro Ile Ala Met
130 135 140

Val Ala Asp Gln Trp Tyr Asp Ile Leu Gly Val Leu Ser Gly Ser Met
145 150 155 160

Thr Val Leu Pro Asn Gly Thr Val Ile Met Ile Tyr Thr Gly Ala Thr
165 170 175

Asn Ala Ser Ala Val Glu Val Gln Cys Ile Ala Thr Pro Ala Asp Pro
180 185 190

Asn Asp Pro Leu Leu Arg Arg Trp Thr Lys His Pro Ala Asn Pro Val
195 200 205

Ile Trp Ser Pro Pro Gly Val Gly Thr Lys Asp Phe Arg Asp Pro Met
210 215 220

Thr Ala Trp Tyr Asp Glu Ser Asp Glu Thr Trp Arg Thr Leu Leu Gly
225 230 235 240

Ser Lys Asp Asp His Asp Gly His His Asp Gly Ile Ala Met Met Tyr
245 250 255

Lys Thr Lys Asp Phe Leu Asn Tyr Glu Leu Ile Pro Gly Ile Leu His
260 265 270

Arg Val Val Arg Thr Gly Glu Trp Glu Cys Ile Asp Phe Tyr Pro Val
275 280 285

Gly Arg Arg Ser Ser Asp Asn Ser Ser Glu Met Leu His Val Leu Lys
290 295 300

Ala Ser Met Asp Asp Glu Arg His Asp Tyr Tyr Ser Leu Gly Thr Tyr
305 310 315 - 320

Asp Ser Ala Ala Asn Thr Trp Thr Pro Ile Asp Pro Glu Leu Asp Leu
325 330 335

Gly Ile Gly Leu Arg Tyr Asp Trp Gly Lys Phe Tyr Ala Ser Thr Ser
340 345 350

Phe Tyr Asp Pro Ala Lys Asn Arg Arg Val Leu Met Gly Tyr Val Gly
355 360 365

Glu Val Asp Ser Lys Arg Ala Asp Val Val Lys Gly Trp Ala Ser Ile
370 375 380

Gln Ser Val Pro Arg Thr Val Ala Leu Asp Glu Lys Thr Arg Thr Asn
385 390 395 400

Leu Leu Leu Trp Pro Val Glu Glu Ile Glu Thr Leu Arg Leu Asn Ala
405 410 415

Thr Glu Leu Thr Asp Val Thr Ile Asn Thr Gly Ser Val Ile His Ile
420 425 430

Pro Leu Arg Gln Gly Thr Gln Leu Asp Ile Glu Ala Ser Phe His Leu
435 440 445

Asp Ala Ser Ala Val Ala Ala Leu Asn Glu Ala Asp Val Gly Tyr Asn
450 455 460

Cys Ser Ser Ser Gly Gly Ala Val Asn Arg Gly Ala Leu Gly Pro Phe
465 470 475 480

Gly Leu Leu Val Leu Ala Ala Gly Asp Arg Arg Gly Glu Gln Thr Ala
485 490 495

Val Tyr Phe Tyr Val Ser Arg Gly Leu Asp Gly Gly Leu His Thr Ser
500 505 510

Phe Cys Gln Asp Glu Leu Arg Ser Ser Arg Ala Lys Asp Val Thr Lys
515 520 525

Arg Val Ile Gly Ser Thr Val Pro Val Leu Asp Gly Glu Ala Leu Ser
530 535 540

Met Arg Val Leu Val Asp His Ser Ile Val Gln Gly Phe Asp Met Gly
545 550 555 560

Gly Arg Thr Thr Met Thr Ser Arg Val Tyr Pro Met Glu Ser Tyr Gln
565 570 575

Glu Ala Arg Val Tyr Leu Phe Asn Asn Ala Thr Gly Ala Ser Val Thr
580 585 590

Ala Glu Arg Leu Val Val His Glu Met Asp Ser Ala His Asn Gln Leu
595 600 605

Ser Asn Glu Asp Asp Gly Met Tyr Leu His Gln Val Leu Glu Ser Arg
610 615 620

His
625